

# PATENT ABSTRACTS OF JAPAN

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(21)Application number : 2004-179858 (71)Applicant : NISSAN MOTOR CO LTD

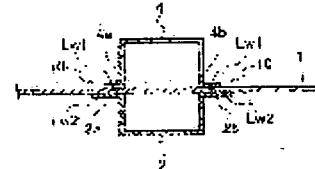
(22)Date of filing : 17.06.2004 (72)Inventor : GENNAI SEI  
SUZUKI YUUI

## (54) LASER WELDING METHOD

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a laser welding method where, even in the case three sheet materials are piled and are subjected to laser welding, the two joining faces among the respective sheet materials can be securely welded under the almost similar conditions without increasing the capacity of a laser beam.

**SOLUTION:** At the time when an intermediate sheet 1, the side edges 4a, 4b and 2a, 2b in joining sheets 4, 2 respectively arranged on both the faces of the intermediate sheet 1 are subjected to laser welding by a three-sheet pile, width-changed parts 10 in which the shape of the side edges 4a, 4b and 2a, 2b arranged on both the faces of the intermediate sheet 1 is shifted in a projection plane are provided, and laser welding operations Lw1, Lw2 are performed between the respective different width-changed part and the intermediate sheet 1, thus each side edge can be made to a two-sheet pile at the laser welded part with the intermediate sheet 1. In this way, the two places between both the faces of the intermediate sheet 1 and the joining sheets can be securely welded under the almost similar conditions.



### LEGAL STATUS

[Date of request for examination]

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[rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

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CLAIMS

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[Claim(s)]

[Claim 1]

Three sheets hit carrying out laser welding from one side in piles in a middle plate and the joint plate of two sheets arranged to both sides of this middle plate, respectively,

The laser-welding approach characterized by preparing the form status change-sized part which shifted the configuration mutually at the projection flat surface in the weld of the joint plate of two sheets arranged to both sides of a middle plate, and carrying out laser welding to it between each different form status change-sized part and different middle plate.

[Claim 2]

A form status change-sized part is the laser-welding approach according to claim 1 which is the width-of-face change part which made narrower than the polymerization width of face to the middle plate of the side edge of the joint plate of another side polymerization width of face to the middle plate of the side edge of the joint plate arranged to the side which carries out laser welding, and is characterized by carrying out laser welding of the part into which a middle plate and the joint plate of another side project rather than the joint plate by the side of welding while carrying out laser welding of the joint plate and middle plate by the side of welding.

[Claim 3]

A form status change-sized part is the laser-welding approach according to claim 1 which is the side edge change part which formed the side edge of the joint plate arranged to both sides of a middle plate in serrate [ by which Yamabe of one side edge and the trough of the side edge of another side are arranged by turns / the shape of a wave and serrate ], and carries out the description of carrying out laser welding between Yamabe of each side edge, and a middle plate.

[Claim 4]

The side edge change part of each joint plate is the laser-welding approach according to claim 3 which is established one pair, and opposite arrangement is carried out, respectively, and is characterized by forming in asymmetry the side edge change part which each joint plate counters, respectively.

[Claim 5]

The laser-welding approach according to claim 2 characterized by making the laser line used as the locus of laser welding into a wave.

[Claim 6]

The width-of-face change part of each joint plate is the laser-welding approach according to claim 5 which is established one pair, and opposite arrangement is carried out, respectively, and is characterized by making unsymmetrical to mutual the wave of laser welding performed to the side edge change part which each joint plate counters.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

#### [Field of the Invention]

[0001]

This invention relates to the laser-welding approach which carries out laser welding of the panel material by the three-sheet pile.

#### [Background of the Invention]

[0002]

From the upper part of the piled-up metal plate, laser welding irradiates laser light and welds the piled-up metal plates (for example, patent reference 1 reference).

[0003]

This laser welding is the approach of irradiating, where laser light is condensed mainly to a metal, and joining a metal melting and by making it solidify locally.

[Patent reference 1] JP,2000-176664,A (the 6th page, Fig. 1)

#### [Description of the Invention]

#### [Problem(s) to be Solved by the Invention]

[0004]

However, although this conventional laser welding piles up the metal plate of two sheets and he is trying to join it, laser welding of the metal plate of three sheets may be carried out by the case.

[0005]

Thus, if it is going to carry out laser welding of the three sheets to coincide like said former, while it will be necessary to increase the capacity of laser light and cost will increase in carrying out laser welding of the metal plate of three sheets, there is a possibility that it may become impossible to weld two planes of composition between the metal plates of three sheets on the respectively same conditions.

[0006]

Then, this invention offers the laser-welding approach which enabled it to weld certainly the plane of composition of the plate of the both sides on the same conditions as abbreviation to a middle plate, without raising the capacity of laser light, also when carrying out laser welding of the plate of three sheets in piles.

#### [Means for Solving the Problem]

[0007]

In carrying out laser welding of a middle plate and the joint plate of two sheets arranged to both sides of this middle plate, respectively by the three-sheet pile, if it is in this invention, it is characterized [ main ] by preparing the form status change-sized part which was able to shift the configuration mutually at the projection flat surface in the weld of the joint plate of two sheets arranged to both sides of a middle plate, and carrying out laser welding to it between each different form status change-sized part and different middle plate.

#### [Effect of the Invention]

[0008]

It can weld certainly on the same conditions as abbreviation of two planes of composition between middle plate both sides and a joint plate, without according to the laser-welding approach of this invention, raising the capacity of laser light, since the laser-welding part with a middle plate of each

joint plate serves as a two-sheet pile by the form status change-sized part when each joint plate arranged to both sides of a middle plate carries out laser welding of the part from which the form status change-sized part formed in each shifted to a middle plate.

[Best Mode of Carrying Out the Invention]

[0009]

Hereafter, the operation gestalt of this invention is explained in full detail with a drawing.

[0010]

The sectional view of a laser-welding part and drawing 4 of the perspective view in which drawing 1 - drawing 4 show the 1st operation gestalt of the laser-welding approach concerning this invention, and drawing 1 shows the car-body important section's to which this invention's is applied attachment middle, the sectional view of the car-body important section corresponding to the A-A line in drawing 1 in drawing 2 , and drawing 3 are the top views of a laser-welding part.

[0011]

The laser-welding approach of this 1st operation gestalt be apply to a part for the joint of the frontside member 2 combine with the car-body front section of the floor panel 1 , as show in drawing 1 , while be formed in the hat form cross section open up , and the frontside member 2 as a joint plate be combine so that a closed section may be constitute on the inferior surface of tongue of the dash panel 3 as a middle plate , and the floor panel 1 .

[0012]

Moreover, the stiffener member 4 as a joint plate of another side of the hat form cross section caudad opened corresponding to the arrangement part of said frontside member 2 is combined with the top face of said dash panel 3 and said floor panel 1.

[0013]

Ranging over the frontside member 2 bottom and the inferior surface of tongue of the floor panel 1 , the abbreviation triangle-like side inner member 5 is combined with the cross direction (longitudinal direction in drawing 1 ) inside section of floor panel 1 anterior part of said frontside member 2.

[0014]

In addition, while a side sill 6 is formed in the cross direction side edge of said floor panel 1, the front pillar 7 has started from the car-body front edge of this side sill 6. As shown in drawing 2 , while opposite arrangement of flange 2a of the pair as a side edge and the 2b is carried out at the cross direction both-sides section, as for said frontside member 2, opposite arrangement of the flanges 4a and 4b of the pair as a side edge is carried out at the cross direction both-sides section, as for said stiffener member 4.

[0015]

And while contacting the inferior surface of tongue of the floor panel 1 in flange 2a and 2b, as Flanges 4a and 4b are put on said flange 2a and 2b, the top face of the floor panel 1 is made to contact, and he welds each flange 2a, 2b, and flange 4a and 4b parts to the floor panel 1, and is trying to join each to one.

[0016]

Moreover, said side inner member 5 has carried out spot welding of the flange 5a of the method flank of the inside of the cross direction to the inferior surface of tongue of the floor panel 1 while carrying out spot welding of the method flank of the outside of the cross direction to the inferior surface of tongue of the frontside member 2.

[0017]

Therefore, flange 2b of the method of the inside of the cross direction of the frontside member 2 will be covered with said side inner member 5, and will be impossible [ welding that flange 2b to the floor panel 1 directly from a lower part in this covered part ].

[0018]

For this reason, it is made to carry out laser welding of the flanges 4a and 4b arranged on the top face of this on both sides of the floor panel 1, and flange 2a arranged on the inferior surface of tongue and 2b from the upper part side of the floor panel 1.

[0019]

In carrying out laser welding of the panel which became a three-sheet pile with Flanges 4a and 4b, the floor panel 1, and flange 2a and 2b from the upper part with this operation gestalt here, as shown

in drawing 3 It has carried out to the form status change-ized part 10 which shifted the configuration mutually, for example, a width-of-face change part, at the projection flat surface, and is made to carry out laser welding of flange 2a, 2b, and the flanges 4a and 4b between each different width-of-face change part 10 and different floor panel 1.

[0020]

As said width-of-face change part 10 is shown in drawing 4, the width of face W1 of the flanges 4a and 4b arranged to the side which carries out laser beam welding, i.e., the top face of the floor panel 1 While constituting by forming more narrowly than the width of face W2 of flange 2a of another side, and 2b and carrying out Flanges 4a and 4b and the floor panel 1 by the side of welding laser-welding Lw1 The floor panel 1 and the part into which flange 2a of another side and 2b project rather than Flanges 4a and 4b have been carried out laser-welding Lw2.

[0021]

therefore, the width-of-face change part 10 which boiled the flanges 4a and 4b which have been arranged to both sides of the floor panel 1 according to the laser-beam-welding approach of this 1st operation gestalt and flange 2a, and 2b, respectively, and was formed -- the floor panel 1 -- each one side -- setting -- a laser two straight-lines-like line -- having -- laser beam welding Lw1 -- it can take Lw2.

[0022]

For this reason, since Flanges 4a and 4b and flange 2a, and 2b serve as two-sheet pile structure in the laser welding Lw1 with the floor panel 1, and Lw2 part by that form status change-ized part W1 and W2, i.e., different width of face It can weld certainly on the same conditions as abbreviation of two planes of composition, between Flanges 4a and 4b and the floor panel 1 and between flange 2a, 2b, and the floor panels 1, without raising the capacity of laser light.

[0023]

Therefore, without making cost of laser beam welding high, the welding reinforcement of the flange 2a, 2b and 4a and 4b, and the floor panel 1 used as a three-sheet pile can be secured, and it can join certainly.

[0024]

Drawing 5 and drawing 6 shall show the 2nd operation gestalt of this invention, the explanation which attaches the same sign and overlaps shall be omitted and stated to the same component as said 1st operation gestalt, drawing 5 is the sectional view of a laser-welding part, and drawing 6 is the top view of a laser-welding part.

[0025]

As the laser-welding approach of this 2nd operation gestalt is shown in drawing 5 and drawing 6 The side edge of the flanges 4a and 4b which have arranged the side edge change part 11 as a form status change-ized part to both sides of the floor panel 1 and flange 2a, and 2b It forms in the shape of [ by which each Yamabe 4m and 2m and Troughs 4v and 2v are arranged by turns ] a wave (serrate is sufficient). In each one side, it is made to carry out between Yamabe 4m and 2m of each side edge, and the floor panels 1 by the laser one straight-line-like line laser-welding Lw3.

[0026]

Therefore, according to the laser-beam-welding approach of this 2nd operation gestalt, since Yamabe 4m of Flanges 4a and 4b and Yamabe 2m of flange 2a and 2b are arranged by turns by the side edge change part 11, each Yamabe 4m and 2m becomes a two-sheet pile in a contact part with the floor panel 1.

[0027]

For this reason, Flanges 4a and 4b and flange 2a, and 2b The floor panel 1 is received by each Yamabe 4m and 2m. Laser-welding Lw3 as two-sheet pile structure Since it can do, It can weld certainly on the same conditions as abbreviation of two planes of composition between Flanges 4a and 4b and flange 2a, 2b, and the floor panel 1, without raising the capacity of laser light like the 1st operation gestalt.

[0028]

Moreover, by existence of Troughs 4v and 2v, each flanges 4a, 4b, and 2a and 2b can make concentration of the stress by the welding heat small, lenticulate, and can control deformation, respectively.

[0029]

Drawing 7 and drawing 8 shall show the 3rd operation gestalt of this invention, the explanation which attaches the same sign and overlaps shall be omitted and stated to the same component as said each operation gestalt, drawing 7 is the sectional view of a laser-welding part, and drawing 8 is the top view of a laser-welding part.

[0030]

The laser-welding approach of this 3rd operation gestalt has formed in the side edge of Flanges 4a and 4b and flange 2a, and 2b fundamentally the side edge change part 11 formed in the shape of [ by which each Yamabe 4m and 2m and Troughs 4v and 2v are arranged by turns ] a wave (or serrate) like the 2nd operation gestalt, as shown in drawing 7 and drawing 8.

[0031]

And with this operation gestalt, as shown in drawing 8, the side edge change part 11 formed in the flanges 4a and 4b of the right and left which countered the cross direction and flange 2a, and 2b, respectively is formed in asymmetry, respectively.

[0032]

namely, -- although a large number are formed in the die-length direction with the flanges 4a and 4b which countered right and left (cross direction) and flange 2a, Yamabe 4m of 2b, and the fixed pitch P1 2m -- this operation gestalt -- each Yamabe 4m and 2m -- a car cross direction (longitudinal direction in drawing 8 ) -- every [ a half-pitch (P1/2) ] -- it can shift relatively and suppose that it is unsymmetrical.

[0033]

And it is made to make Yamabe 4m and 2m into a car cross direction between each Yamabe 4m and 2m and floor panel 1 in the condition that it was able to shift the half-pitch every laser-welding Lw3 like said 2nd operation gestalt in this way.

[0034]

According to the laser-beam-welding approach of this 3rd operation gestalt, therefore, Flanges 4a and 4b and flange 2a, 2b, and the floor panel 1 While being able to take laser-welding Lw3 as two-sheet pile structure by each Yamabe 4m and 2m It can ease that stress concentrates on Flanges 4a and 4b and flange 2a, and 2b like the 2nd operation gestalt by the ability having shifted each Yamabe 4m and 2m to the car cross direction.

[0035]

Drawing 9 and drawing 10 shall show the 4th operation gestalt of this invention, the explanation which attaches the same sign and overlaps shall be omitted and stated to the same component as said each operation gestalt, drawing 9 is the sectional view of a laser-welding part, and drawing 10 is the top view of a laser-welding part.

[0036]

As shown in drawing 9 and drawing 10, the laser-welding approach of this 4th operation gestalt forms the width-of-face change part 10 like the 1st operation gestalt fundamentally, and constitutes it by forming more narrowly than the width of face W2 of flange 2a of another side, and 2b the width of face W1 of the flanges 4a and 4b arranged to the top-face side of the floor panel 1.

[0037]

and with this operation gestalt, as shown in drawing 10, as it is alike and straddles, one laser line is made into the shape of a wave in each one side, and it has taken laser-welding Lw4 for the two-sheet pile part of the flanges 4a and 4b by the side of welding, and the floor panel 1, and the two-sheet pile part of the floor panel 1 and the part into which flange 2a of another side and 2b project rather than Flanges 4a and 4b.

[0038]

Therefore, according to the laser-welding approach of this 4th operation gestalt, even if it welds by the same laser capacity as the 1st - the 3rd operation gestalt In the part from which Flanges 4a and 4b and flange 2a, 2b, and the floor panel 1 became a three-sheet pile Flanges 4a and 4b and the floor panel 1 -- moreover, in flange 2a and the part projected rather than the flanges 4a and 4b of 2b, flange 2a, 2b, and the floor panel 1 While being welded, respectively and being able to take laser-welding Lw4 by one laser line moreover Since the long die length of the welding Lw4 to the predetermined die length of this weld can be taken by having made the laser line of this laser

welding Lw4 into the shape of a wave, welding reinforcement can be raised.

[0039]

Drawing 11 and drawing 12 shall show the 5th operation gestalt of this invention, the explanation which attaches the same sign and overlaps shall be omitted and stated to the same component as said each operation gestalt, drawing 11 is the sectional view of a laser-welding part, and drawing 12 is the top view of a laser-welding part.

[0040]

As the laser-welding approach of this 5th operation gestalt is shown in drawing 11 and drawing 12. The width of face W1 of the flanges 4a and 4b which formed the width-of-face change part 10 like the 1st operation gestalt fundamentally, and have been arranged to the top-face side of the floor panel 1. It constitutes by forming more narrowly than the width of face W2 of flange 2a of another side, and 2b, and one laser line is made into the shape of a wave in each one side like the 4th operation gestalt, and it has taken laser-welding Lw4.

[0041]

And with this operation gestalt, as shown in drawing 12, the wave of the laser welding Lw4 performed between the flanges 4a and 4b on either side and flange 2a, 2bs, and the floor panels 1 which countered the cross direction is mutually made unsymmetrical by right and left.

[0042]

namely, the laser beam welding Lw4 of the pair given to right and left -- the pitch P2 of the wave part -- a car cross direction (longitudinal direction in drawing 12 ) -- every [ a half-pitch (P2/2) ] -- it can shift relatively and suppose that it is unsymmetrical.

[0043]

Therefore, since the wave part of the laser welding Lw4 which accomplishes the pair given face to face was mutually made unsymmetrical according to the laser-welding approach of this 5th operation gestalt, on the whole, the stress concentration which acts on the wave part of laser welding Lw4 can be eased.

[0044]

by the way , various adoption of other operation gestalten can be carry out in the range which do not deviate from the summary of this invention , without restricting to these operations gestalt , and it be needless to say [ a middle plate or a joint plate ] , although the laser welding approach of this invention took the example in said the 1st - 5th operation gestalt and be explained to them that this invention be applicable to the matter at large in which laser welding be possible , without restricting to metals use for a car body , such as a steel plate and an aluminum plate .

[Brief Description of the Drawings]

[0045]

[Drawing 1] It is the perspective view showing the car-body important section's to which this invention's is applied attachment middle.

[Drawing 2] It is the sectional view of the car-body important section corresponding to the A-A line in drawing 1 .

[Drawing 3] It is the sectional view of the laser-welding part in the 1st operation gestalt of this invention.

[Drawing 4] It is the top view of the laser-welding part in the 1st operation gestalt of this invention.

[Drawing 5] It is the sectional view of the laser-welding part in the 2nd operation gestalt of this invention.

[Drawing 6] It is the top view of the laser-welding part in the 2nd operation gestalt of this invention.

[Drawing 7] It is the sectional view of the laser-welding part in the 3rd operation gestalt of this invention.

[Drawing 8] It is the top view of the laser-welding part in the 3rd operation gestalt of this invention.

[Drawing 9] It is the sectional view of the laser-welding part in the 4th operation gestalt of this invention.

[Drawing 10] It is the top view of the laser-welding part in the 4th operation gestalt of this invention.

[Drawing 11] It is the sectional view of the laser-welding part in the 5th operation gestalt of this invention.

[Drawing 12] It is the top view of the laser-welding part in the 5th operation gestalt of this invention.

[Description of Notations]

[0046]

1 Floor Panel (Middle Plate)

2 Frontside Member (Joint Plate)

2a, 2b Flange (side edge)

2m Yamabe

2v Trough

4 Stiffener Member (Joint Plate)

4a, 4b Flange (side edge)

4m Yamabe

4v Trough

10 Width-of-Face Change Part (Form Status Change-ized Part)

11 Side Edge Change Part (Form Status Change-ized Part)

Lw1, Lw2, Lw3, Lw4 Laser welding

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**CLAIMS**

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[Claim(s)]

[Claim 1]

Three sheets hit carrying out laser welding from one side in piles in a middle plate and the joint plate of two sheets arranged to both sides of this middle plate, respectively, The laser-welding approach characterized by preparing the form status change-sized part which shifted the configuration mutually at the projection flat surface in the weld of the joint plate of two sheets arranged to both sides of a middle plate, and carrying out laser welding to it between each different form status change-sized part and different middle plate.

[Claim 2]

A form status change-sized part is the laser-welding approach according to claim 1 which is the width-of-face change part which made narrower than the polymerization width of face to the middle plate of the side edge of the joint plate of another side polymerization width of face to the middle plate of the side edge of the joint plate arranged to the side which carries out laser welding, and is characterized by carrying out laser welding of the part into which a middle plate and the joint plate of another side project rather than the joint plate by the side of welding while carrying out laser welding of the joint plate and middle plate by the side of welding.

[Claim 3]

A form status change-sized part is the laser-welding approach according to claim 1 which is the side edge change part which formed the side edge of the joint plate arranged to both sides of a middle plate in serrate [ by which Yamabe of one side edge and the trough of the side edge of another side are arranged by turns / the shape of a wave and serrate ], and carries out the description of carrying out laser welding between Yamabe of each side edge, and a middle plate.

[Claim 4]

The side edge change part of each joint plate is the laser-welding approach according to claim 3 which is established one pair, and opposite arrangement is carried out, respectively, and is characterized by forming in asymmetry the side edge change part which each joint plate counters, respectively.

[Claim 5]

The laser-welding approach according to claim 2 characterized by making the laser line used as the locus of laser welding into a wave.

[Claim 6]

The width-of-face change part of each joint plate is the laser-welding approach according to claim 5 which is established one pair, and opposite arrangement is carried out, respectively, and is characterized by making unsymmetrical to mutual the wave of laser welding performed to the side edge change part which each joint plate counters.

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[Translation done.]

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## DESCRIPTION OF DRAWINGS

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### [Brief Description of the Drawings]

[0045]

[Drawing 1] It is the perspective view showing the car-body important section's to which this invention's is applied attachment middle.

[Drawing 2] It is the sectional view of the car-body important section corresponding to the A-A line in drawing 1.

[Drawing 3] It is the sectional view of the laser-welding part in the 1st operation gestalt of this invention.

[Drawing 4] It is the top view of the laser-welding part in the 1st operation gestalt of this invention.

[Drawing 5] It is the sectional view of the laser-welding part in the 2nd operation gestalt of this invention.

[Drawing 6] It is the top view of the laser-welding part in the 2nd operation gestalt of this invention.

[Drawing 7] It is the sectional view of the laser-welding part in the 3rd operation gestalt of this invention.

[Drawing 8] It is the top view of the laser-welding part in the 3rd operation gestalt of this invention.

[Drawing 9] It is the sectional view of the laser-welding part in the 4th operation gestalt of this invention.

[Drawing 10] It is the top view of the laser-welding part in the 4th operation gestalt of this invention.

[Drawing 11] It is the sectional view of the laser-welding part in the 5th operation gestalt of this invention.

[Drawing 12] It is the top view of the laser-welding part in the 5th operation gestalt of this invention.

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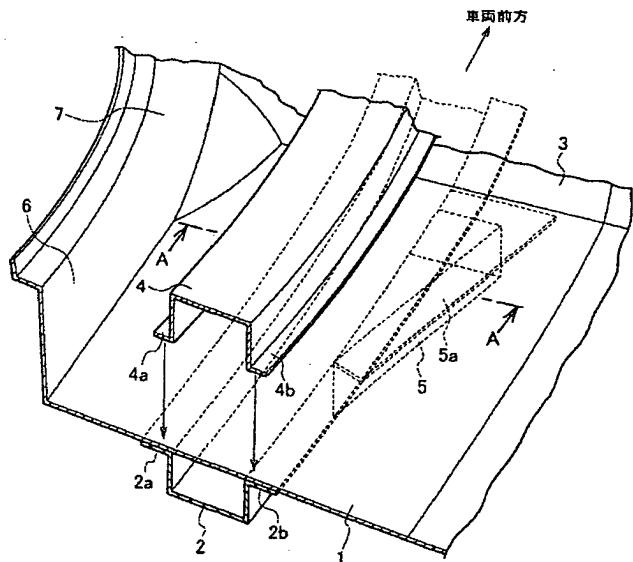
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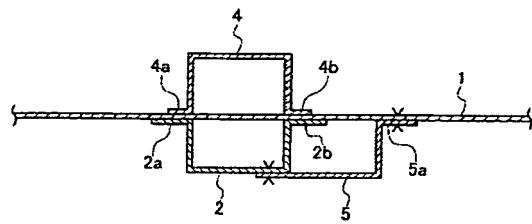
DRAWINGS

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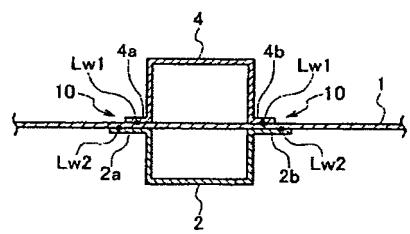
## [Drawing 1]



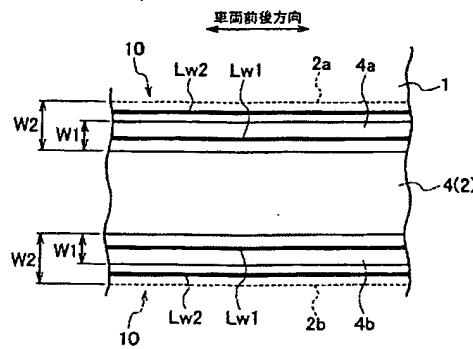
## [Drawing 2]



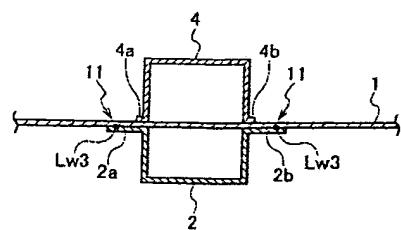
[Drawing 3]



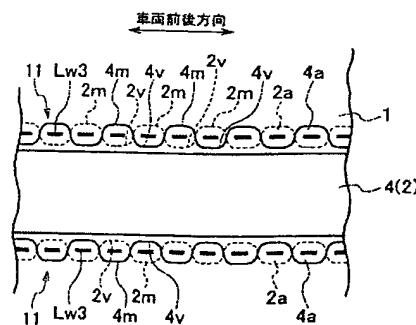
[Drawing 4]



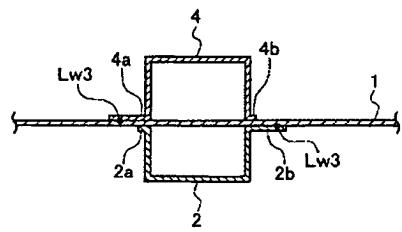
[Drawing 5]



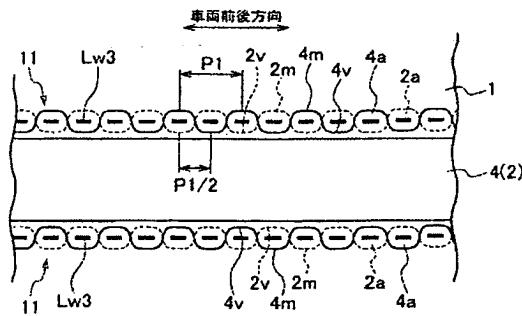
[Drawing 6]



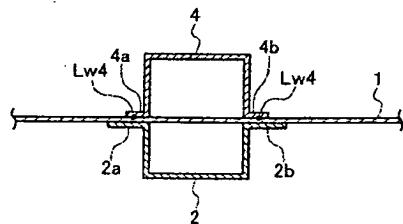
[Drawing 7]



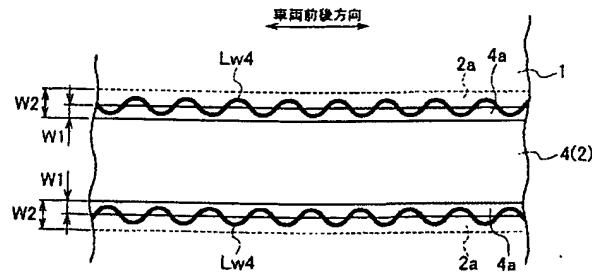
[Drawing 8]



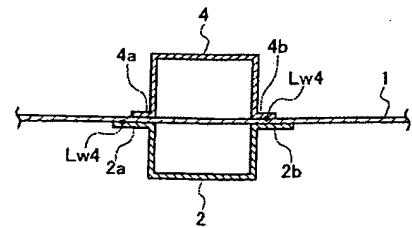
[Drawing 9]



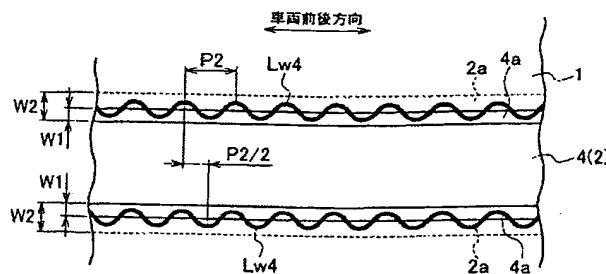
[Drawing 10]



[Drawing 11]



[Drawing 12]




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[Translation done.]

**\* NOTICES \***

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---

**TECHNICAL PROBLEM**

---

**[Problem(s) to be Solved by the Invention]****[0004]**

However, although this conventional laser welding piles up the metal plate of two sheets and he is trying to join it, laser welding of the metal plate of three sheets may be carried out by the case.

**[0005]**

Thus, if it is going to carry out laser welding of the three sheets to coincidence like said former, while it will be necessary to increase the capacity of laser light and cost will increase in carrying out laser welding of the metal plate of three sheets, there is a possibility that it may become impossible to weld two planes of composition between the metal plates of three sheets on the respectively same conditions.

**[0006]**

Then, this invention offers the laser-welding approach which enabled it to weld certainly the plane of composition of the plate of the both sides on the same conditions as abbreviation to a middle plate, without raising the capacity of laser light, also when carrying out laser welding of the plate of three sheets in piles.

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**[Translation done.]**

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**TECHNICAL FIELD**

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**[Field of the Invention]****[0001]**

This invention relates to the laser-welding approach which carries out laser welding of the panel material by the three-sheet pile.

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[Translation done.]

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**PRIOR ART**

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**[Background of the Invention]****[0002]**

From the upper part of the piled-up metal plate, laser welding irradiates laser light and welds the piled-up metal plates (for example, patent reference 1 reference).

**[0003]**

This laser welding is the approach of irradiating, where laser light is condensed mainly to a metal, and joining a metal melting and by making it solidify locally.

[Patent reference 1] JP,2000-176664,A (the 6th page, Fig. 1)

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[Translation done.]

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## EFFECT OF THE INVENTION

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### [Effect of the Invention]

[0008]

It can weld certainly on the same conditions as abbreviation of two planes of composition between middle plate both sides and a joint plate, without according to the laser-welding approach of this invention, raising the capacity of laser light, since the laser-welding part with a middle plate of each joint plate serves as a two-sheet pile by the form status change-ized part when each joint plate arranged to both sides of a middle plate carries out laser welding of the part from which the form status change-ized part formed in each shifted to a middle plate.

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[Translation done.]

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## TECHNICAL PROBLEM

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### [Problem(s) to be Solved by the Invention]

[0004]

However, although this conventional laser welding piles up the metal plate of two sheets and he is trying to join it, laser welding of the metal plate of three sheets may be carried out by the case.

[0005]

Thus, if it is going to carry out laser welding of the three sheets to coincidence like said former, while it will be necessary to increase the capacity of laser light and cost will increase in carrying out laser welding of the metal plate of three sheets, there is a possibility that it may become impossible to weld two planes of composition between the metal plates of three sheets on the respectively same conditions.

[0006]

Then, this invention offers the laser-welding approach which enabled it to weld certainly the plane of composition of the plate of the both sides on the same conditions as abbreviation to a middle plate, without raising the capacity of laser light, also when carrying out laser welding of the plate of three sheets in piles.

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[Translation done.]

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(71) 出願人 000003997

日産自動車株式会社

神奈川県横浜市神奈川区宝町2番地

(74) 代理人 100083806

弁理士 三好 秀和

(74) 代理人 100100712

弁理士 岩▲崎▼ 幸邦

(74) 代理人 100087365

弁理士 栗原 彰

(74) 代理人 100100929

弁理士 川又 澄雄

(74) 代理人 100095500

弁理士 伊藤 正和

(74) 代理人 100101247

弁理士 高橋 俊一

最終頁に続く

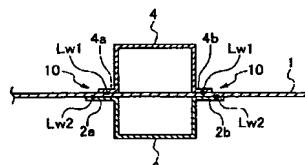
(54) 【発明の名称】 レーザー溶接方法

## (57) 【要約】

【課題】 3枚の板材を重ねてレーザー溶接する場合にも、レーザー光の容量を上げることなく、それぞれの板材間の2箇所の接合面を略同様の条件で確実に溶接できるようにしたレーザー溶接方法の提供を図る。

【解決手段】 中間板1と、この中間板1の両面にそれぞれ配置した接合板4、2の側縁4a、4bおよび2a、2bと、を3枚重ねでレーザー溶接するにあたって、中間板1の両面に配置した側縁4a、4bおよび2a、2bを、投影平面で形状をずらした幅変化部分10を設け、それぞれの異なる幅変化部分と中間板1との間でレーザー溶接Lw1、Lw2することにより、各側縁は中間板1とのレーザー溶接部分で2枚重ねにできるので、レーザー光の容量を上げることなく、中間板両面と接合板との間の2箇所の接合面を略同様の条件で確実に溶接できる。

【選択図】 図3



## 【特許請求の範囲】

## 【請求項 1】

中間板と、この中間板の両面にそれぞれ配置した2枚の接合板と、を3枚重ねて一方側からレーザー溶接するにあたって、

中間板の両面に配置した2枚の接合板の溶接部分に、投影平面で形状を相互にずらした形状変化部分を設け、それぞれの異なった形状変化部分と中間板との間でレーザー溶接することを特徴とするレーザー溶接方法。

## 【請求項 2】

形状変化部分は、レーザー溶接する側に配置した接合板の側縁の中間板に対する重合幅を他方の接合板の側縁の中間板に対する重合幅よりも狭くした幅変化部分であり、溶接側の接合板と中間板とをレーザー溶接するとともに、中間板と他方の接合板が溶接側の接合板よりも突出する部分とをレーザー溶接することを特徴とする請求項1に記載のレーザー溶接方法。

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## 【請求項 3】

形状変化部分は、中間板の両面に配置した接合板の側縁を、一方の側縁の山部と他方の側縁の谷部とが交互に配置される波形状若しくは鋸歯状に形成した側縁変化部分であり、それぞれの側縁の山部と中間板との間でレーザー溶接することを特徴とする請求項1に記載のレーザー溶接方法。

## 【請求項 4】

各接合板の側縁変化部分は、それぞれ一対設けられて対向配置され、各接合板の対向する側縁変化部分をそれぞれ非対称に形成したことを特徴とする請求項3に記載のレーザー溶接方法。

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## 【請求項 5】

レーザー溶接の軌跡となるレーザー線を波形にしたことを特徴とする請求項2に記載のレーザー溶接方法。

## 【請求項 6】

各接合板の幅変化部分は、それぞれ一対設けられて対向配置され、各接合板の対向する側縁変化部分に施すレーザー溶接の波形を相互に非対称にしたことを特徴とする請求項5に記載のレーザー溶接方法。

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## 【発明の詳細な説明】

## 【技術分野】

## 【0001】

本発明は、パネル材を3枚重ねでレーザー溶接するレーザー溶接方法に関する。

## 【背景技術】

## 【0002】

レーザー溶接は、重ね合わせた金属板の上方からレーザー光を照射して、重ね合わせた金属板どうしを溶接するものである（例えば、特許文献1参照）。

## 【0003】

このレーザー溶接とは、レーザー光を主として金属に集光した状態で照射し、金属を局部的に溶融・凝固させることによって接合する方法である。

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## 【特許文献1】特開2000-176664号公報（第6頁、第1図）

## 【発明の開示】

## 【発明が解決しようとする課題】

## 【0004】

しかしながら、かかる従来のレーザー溶接は2枚の金属板を重ね合わせて接合するようしているが、場合によって3枚の金属板をレーザー溶接する場合がある。

## 【0005】

このように3枚の金属板をレーザー溶接するにあたって、前記従来と同様に3枚を同時にレーザー溶接しようとすると、レーザー光の容量を増大する必要がありコストが嵩んてしまうとともに、3枚の金属板間の2箇所の接合面をそれぞれ同様の条件で溶接できなく

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なる恐れがある。

【0006】

そこで、本発明は3枚の板材を重ねてレーザー溶接する場合にも、レーザー光の容量を上げることなく、中間の板材に対してその両面の板材の接合面を略同様の条件で確実に溶接できるようにしたレーザー溶接方法を提供するものである。

【課題を解決するための手段】

【0007】

本発明にあっては、中間板と、この中間板の両面にそれぞれ配置した2枚の接合板と、を3枚重ねでレーザー溶接するにあたって、中間板の両面に配置した2枚の接合板の溶接部分に、投影平面で形状を相互にずらせた形状変化部分を設け、それぞれの異なった形状変化部分と中間板との間でレーザー溶接することを最も主要な特徴とする。10

【発明の効果】

【0008】

本発明のレーザー溶接方法によれば、中間板の両面に配置した各接合板は、それぞれに形成した形状変化部分のずれた部分を中間板にレーザー溶接することにより、各接合板は形状変化部分によって中間板とのレーザー溶接部分が2枚重ねとなるので、レーザー光の容量を上げることなく、中間板両面と接合板との間の2箇所の接合面を略同様の条件で確実に溶接できる。

【発明を実施するための最良の形態】

【0009】

以下、本発明の実施形態を図面と共に詳述する。20

【0010】

図1～図4は本発明にかかるレーザー溶接方法の第1実施形態を示し、図1は本発明が適用される車体要部の組付け途中を示す斜視図、図2は図1中A-A線に対応する車体要部の断面図、図3はレーザー溶接部分の断面図、図4はレーザー溶接部分の平面図である。。

【0011】

この第1実施形態のレーザー溶接方法は、図1に示すようにフロアパネル1の車体前方部に結合されるフロントサイドメンバ2の接合部分に適用され、上方に開放するハット形断面に形成された一方の接合板としてのフロントサイドメンバ2は、中間板としてのダッシュパネル3およびフロアパネル1の下面に閉断面を構成するように結合される。30

【0012】

また、前記ダッシュパネル3および前記フロアパネル1の上面には、前記フロントサイドメンバ2の配置部分に対応して下方に開放するハット形断面の他方の接合板としてのステイフナーメンバ4を結合してある。

【0013】

前記フロントサイドメンバ2のフロアパネル1前部の車幅方向（図1中左右方向）内側部には、フロントサイドメンバ2の下側とフロアパネル1の下面に跨って略三角形状のサイドインナーメンバ5を結合してある。

【0014】

尚、前記フロアパネル1の車幅方向側縁にはサイドシル6が設けられるとともに、このサイドシル6の車体前方端部からフロントピラー7が立ち上がっている。図2に示すように、前記フロントサイドメンバ2は、車幅方向両側部に側縁としての一対のフランジ2a, 2bが対向配置されるとともに、前記ステイフナーメンバ4は、車幅方向両側部に側縁としての一対のフランジ4a, 4bが対向配置されている。40

【0015】

そして、フランジ2a, 2bをフロアパネル1の下面に当接するとともに、フランジ4a, 4bを前記フランジ2a, 2bに重ねるようにしてフロアパネル1の上面に当接させ、それぞれのフランジ2a, 2bおよびフランジ4a, 4b部分を、フロアパネル1に溶接してそれを一体に接合するようにしている。

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## 【0016】

また、前記サイドインナメンバ5は、その車幅方向外方側部をフロントサイドメンバ2の下面にスポット溶接するとともに、車幅方向内方側部のフランジ5aをフロアパネル1の下面にスポット溶接してある。

## 【0017】

従って、フロントサイドメンバ2の車幅方向内方のフランジ2bは前記サイドインナメンバ5によって覆われることになり、この覆われた部分でそのフランジ2bを下方からフロアパネル1に直接溶接することが不可能となってしまう。

## 【0018】

このため、フロアパネル1を挟んでこれの上面に配置したフランジ4a, 4bと下面に配置したフランジ2a, 2bとを、フロアパネル1の上方側からレーザー溶接するようにしている。

## 【0019】

ここで、本実施形態では、フランジ4a, 4bとフロアパネル1とフランジ2a, 2bとによって3枚重ねとなったパネルを上方からレーザー溶接するにあたって、図3に示すように、フランジ2a, 2bおよびフランジ4a, 4bを、投影平面で形状を相互にずらした形状変化部分、例えば幅変化部分10としてあり、それぞれの異なる幅変化部分10とフロアパネル1との間でレーザー溶接するようにしている。

## 【0020】

前記幅変化部分10は、図4に示すように、レーザー溶接する側、つまりフロアパネル1の上面側に配置したフランジ4a, 4bの幅W1を、他方のフランジ2a, 2bの幅W2よりも狭く形成することにより構成し、溶接側のフランジ4a, 4bとフロアパネル1とをレーザー溶接Lw1するとともに、フロアパネル1と他方のフランジ2a, 2bがフランジ4a, 4bよりも突出する部分とをレーザー溶接Lw2してある。

## 【0021】

従って、この第1実施形態のレーザー溶接方法によれば、フロアパネル1の両面に配置したフランジ4a, 4bおよびフランジ2a, 2bは、それぞれに形成した幅変化部分10をフロアパネル1に、それぞれの片側において2本の直線状のレーザー線をもってレーザー溶接Lw1, Lw2することができる。

## 【0022】

このため、フランジ4a, 4bおよびフランジ2a, 2bはその形状変化部分、つまり、異なる幅W1, W2によってフロアパネル1とのレーザー溶接Lw1, Lw2部分で2枚重ね構造となるので、レーザー光の容量を上げることなく、フランジ4a, 4bとフロアパネル1との間、およびフランジ2a, 2bとフロアパネル1との間の2箇所の接合面を略同様の条件で確実に溶接することができる。

## 【0023】

従って、レーザー溶接のコストを高くすることなく、3枚重ねとなったフランジ2a, 2bおよび4a, 4bとフロアパネル1との溶接強度を確保して確実に接合することができる。

## 【0024】

図5, 図6は本発明の第2実施形態を示し、前記第1実施形態と同一構成部分に同一符号を付して重複する説明を省略して述べるものとし、図5はレーザー溶接部分の断面図、図6はレーザー溶接部分の平面図である。

## 【0025】

この第2実施形態のレーザー溶接方法は、図5, 図6に示すように、形状変化部分としての側縁変化部分11を、フロアパネル1の両面に配置したフランジ4a, 4bおよびフランジ2a, 2bの側縁を、それぞれの山部4m, 2mと谷部4v, 2vとが交互に配置される波形状（鋸歯状でもよい）に形成し、それぞれの側縁の山部4m, 2mとフロアパネル1との間を、それぞれの片側において1本の直線状のレーザー線によってレーザー溶接Lw3するようにしている。

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## 【0026】

従って、この第2実施形態のレーザー溶接方法によれば、側縁変化部分11によってフランジ4a, 4bの山部4mと、フランジ2a, 2bの山部2mとは交互に配置されるため、それぞれの山部4mおよび2mはフロアパネル1との当接部分で2枚重ねとなる。

## 【0027】

このため、フランジ4a, 4bおよびフランジ2a, 2bは、それぞれの山部4m, 2mによってフロアパネル1に対して2枚重ね構造としてレーザー溶接Lw3できるため、第1実施形態と同様にレーザー光の容量を上げることなく、フランジ4a, 4bおよびフランジ2a, 2bとフロアパネル1との間の2箇所の接合面を略同様の条件で確実に溶接することができる。

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## 【0028】

また各フランジ4a, 4bおよび2a, 2bは、それぞれ谷部4v, 2vの存在により、溶接熱による応力の集中を小さくできて波打ち変形を抑制することができる。

## 【0029】

図7, 図8は本発明の第3実施形態を示し、前記各実施形態と同一構成部分に同一符号を付して重複する説明を省略して述べるものとし、図7はレーザー溶接部分の断面図、図8はレーザー溶接部分の平面図である。

## 【0030】

この第3実施形態のレーザー溶接方法は、図7, 図8に示すように、基本的に第2実施形態と同様に、フランジ4a, 4bおよびフランジ2a, 2bの側縁に、それぞれの山部4m, 2mと谷部4v, 2vとが交互に配置される波形状（または鋸歯状）に形成した側縁変化部分11を形成してある。

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## 【0031】

そして、本実施形態では図8に示すように、車幅方向に対向した左右のフランジ4a, 4bおよびフランジ2a, 2bにそれぞれ形成した側縁変化部分11をそれぞれ非対称に形成してある。

## 【0032】

即ち、左右（車幅方向）に対向したフランジ4a, 4bおよびフランジ2a, 2bの山部4m, 2mは一定のピッチP1をもって長さ方向に多数形成されるが、本実施形態ではそれぞれの山部4m, 2mを、車両前後方向（図8中左右方向）に半ピッチ（P1/2）づつ相対的にずらせて非対称としてある。

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## 【0033】

そして、このように山部4m, 2mを車両前後方向に半ピッチづつずらせた状態で、前記第2実施形態と同様にそれぞれの山部4m, 2mとフロアパネル1との間でレーザー溶接Lw3するようにしている。

## 【0034】

従って、この第3実施形態のレーザー溶接方法によれば、フランジ4a, 4bおよびフランジ2a, 2bとフロアパネル1とを、それぞれの山部4m, 2mによって2枚重ね構造としてレーザー溶接Lw3することができるとともに、それぞれの山部4m, 2mを車両前後方向にずらせたことにより、第2実施形態と同様にフランジ4a, 4bおよびフランジ2a, 2bに応力が集中するのを緩和することができる。

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## 【0035】

図9, 図10は本発明の第4実施形態を示し、前記各実施形態と同一構成部分に同一符号を付して重複する説明を省略して述べるものとし、図9はレーザー溶接部分の断面図、図10はレーザー溶接部分の平面図である。

## 【0036】

この第4実施形態のレーザー溶接方法は、図9, 図10に示すように、基本的に第1実施形態と同様に幅変化部分10を設けて、フロアパネル1の上面側に配置したフランジ4a, 4bの幅W1を、他方のフランジ2a, 2bの幅W2よりも狭く形成することにより構成してある。

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## 【0037】

そして、本実施形態では図10に示すように、溶接側のフランジ4a, 4bとフロアパネル1との2枚重ね部分と、フロアパネル1と他方のフランジ2a, 2bがフランジ4a, 4bよりも突出する部分との2枚重ね部分と、に跨るようにしてそれぞれの片側において1本のレーザー線を波形状にしてレーザー溶接Lw4してある。

## 【0038】

従って、この第4実施形態のレーザー溶接方法によれば、第1～第3実施形態と同様のレーザー容量で溶接しても、フランジ4a, 4bおよびフランジ2a, 2bとフロアパネル1とが3枚重ねとなった部分では、フランジ4a, 4bとフロアパネル1とが、また、フランジ2a, 2bのフランジ4a, 4bよりも突出した部分ではフランジ2a, 2bとフロアパネル1とが、それぞれ溶接され、しかも、1本のレーザー線でレーザー溶接Lw4することができるとともに、このレーザー溶接Lw4のレーザー線を波形状にしたことにより、この溶接部分の所定長さに対する溶接Lw4の長さを長く取ることができたため、溶接強度を高めることができる。

## 【0039】

図11, 図12は本発明の第5実施形態を示し、前記各実施形態と同一構成部分に同一符号を付して重複する説明を省略して述べるものとし、図11はレーザー溶接部分の断面図、図12はレーザー溶接部分の平面図である。

## 【0040】

この第5実施形態のレーザー溶接方法は、図11, 図12に示すように、基本的に第1実施形態と同様に幅変化部分10を設けて、フロアパネル1の上面側に配置したフランジ4a, 4bの幅W1を、他方のフランジ2a, 2bの幅W2よりも狭く形成することにより構成してあり、また、第4実施形態と同様にそれぞれの片側において1本のレーザー線を波形状にしてレーザー溶接Lw4してある。

## 【0041】

そして、本実施形態では図12に示すように、車幅方向に対向した左右のフランジ4a, 4bおよびフランジ2a, 2bとフロアパネル1との間に施したレーザー溶接Lw4の波形を、左右で相互に非対称としてある。

## 【0042】

即ち、左右に施した一対のレーザー溶接Lw4は、その波形部分のピッチP2を車両前後方向(図12中左右方向)に半ピッチ(P2/2)づつ相対的にずらせて非対称としてある。

## 【0043】

従って、この第5実施形態のレーザー溶接方法によれば、対向して施された対を成すレーザー溶接Lw4の波形部分を相互に非対称としたので、レーザー溶接Lw4の波形部分に作用する応力集中を全体的に緩和することができる。

## 【0044】

ところで、本発明のレーザー溶接方法は前記第1～第5実施形態に例をとって説明したが、これら実施形態に限ることなく本発明の要旨を逸脱しない範囲で他の実施形態を各種採用することができ、中間板や接合板は車体に用いられる鋼板やアルミ板等の金属に限ることなく、レーザー溶接が可能な物質全般に本発明を適用できることは勿論である。

## 【図面の簡単な説明】

## 【0045】

【図1】本発明が適用される車体要部の組付け途中を示す斜視図である。

【図2】図1中A-A線に対応する車体要部の断面図である。

【図3】本発明の第1実施形態におけるレーザー溶接部分の断面図である。

【図4】本発明の第1実施形態におけるレーザー溶接部分の平面図である。

【図5】本発明の第2実施形態におけるレーザー溶接部分の断面図である。

【図6】本発明の第2実施形態におけるレーザー溶接部分の平面図である。

【図7】本発明の第3実施形態におけるレーザー溶接部分の断面図である。

【図 8】本発明の第 3 実施形態におけるレーザー溶接部分の平面図である。

【図 9】本発明の第 4 実施形態におけるレーザー溶接部分の断面図である。

【図 10】本発明の第 4 実施形態におけるレーザー溶接部分の平面図である。

【図 11】本発明の第 5 実施形態におけるレーザー溶接部分の断面図である。

【図 12】本発明の第 5 実施形態におけるレーザー溶接部分の平面図である。

【符号の説明】

【0046】

1 フロアパネル（中間板）

2 フロントサイドメンバ（接合板）

2a, 2b フランジ（側縁）

2m 山部

2v 谷部

4 ステイフナーメンバ（接合板）

4a, 4b フランジ（側縁）

4m 山部

4v 谷部

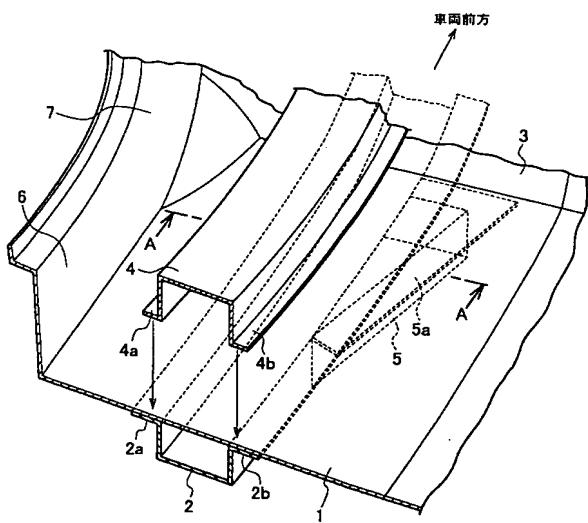
10 幅変化部分（形状変化部分）

11 側縁変化部分（形状変化部分）

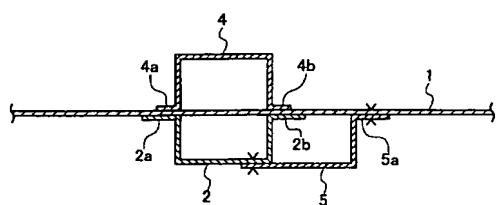
Lw1, Lw2, Lw3, Lw4 レーザー溶接

10

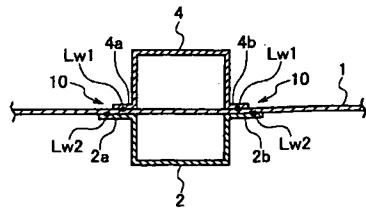
【図 1】



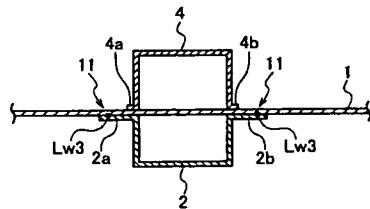
【図 2】



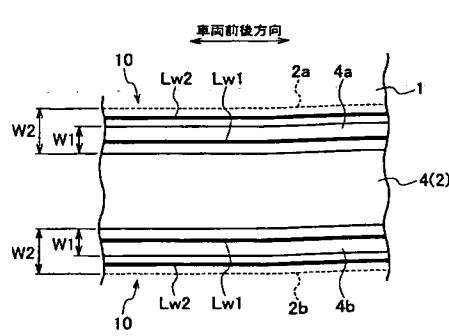
[ 図 3 ]



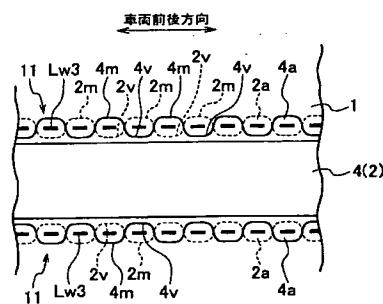
〔 図 5 〕



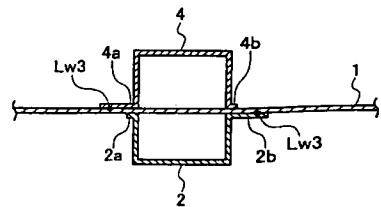
〔四四〕



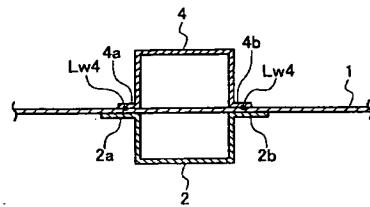
【圖 6】



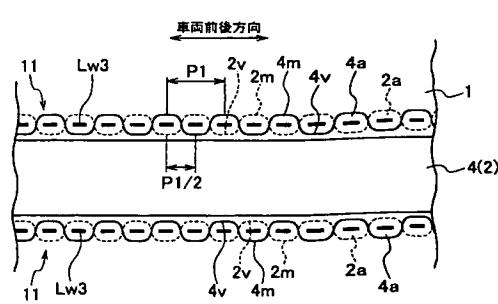
〔図7〕



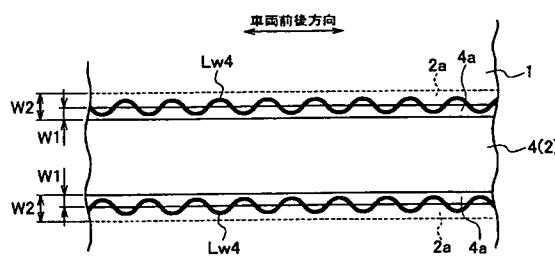
【図9】



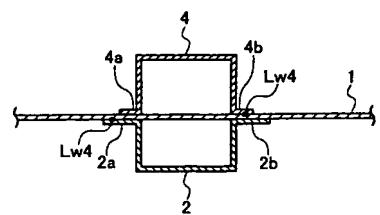
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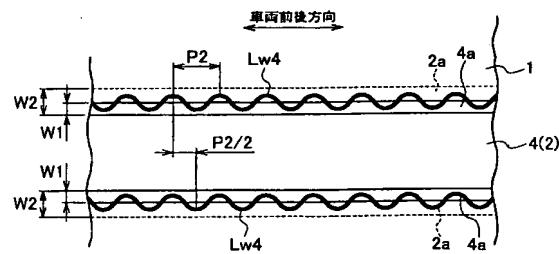
【図 10】



【図 1 1】



【図 1 2】



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フロントページの続き

(74)代理人 100098327  
弁理士 高松 俊雄

(72)発明者 源内 聖  
神奈川県横浜市神奈川区宝町2番地 日産自動車株式会社内

(72)発明者 鈴木 由衣  
神奈川県座間市ひばりが丘5-51-5 株式会社日産テクノ内

F ターム(参考) 4E068 BF00 DB01